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Remarks

Claims 1-40 were originally filed with the present application. Restriction to one of two inventions, method or composite product, was required and the claims of Group I, consisting of method claims 1-10, 12-15, 17-28, 30-37, 39 and 40, were provisionally elected. The outstanding Office action states that restriction is required because "the product as claimed can be made by another, materially different process such as in-situ precipitation of nano-sized phases in a metallic structure" (paragraph 2, page 2). The restriction is traversed on the grounds that the product claims of Group II recite, "components produced by the method" of the method claims of Group I. Because this language stipulates that the components are produced by the claimed methods, components produced by any other method would not be encompassed by the claims. Therefore, rejoinder of claims 11, 16, 29 and 38 is requested. However, for purposes of this response, the election is hereby affirmed and claims 11, 16, 29 and 38 are withdrawn, pending reconsideration of the restriction requirement.

The Office Action states that claims 17-20, 30, 39 and 40 are objected to as being dependent on a rejected base claim, but would be allowable if rewritten independent form. This indication of allowable subject matter is gratefully acknowledged.

Rejections Under 35 U.S.C. §103

Claims 1-4 are rejected under 35 U.S.C. §103(a) as being obvious over Kawabe, *et al.*, (CA 1996:630050, from *Shizuoka Ind. Res. Inst., Shizuoka*, 421-12 (1996)). The rejection is traversed.

The Kawabe reference relates to synthesis of aluminum alloys reinforced with dispersed nanoparticles of SiC using a "vortex method". No description of the "vortex method" is provided in the cited abstract. The Office action admits that the abstract does not use the term "convection vortex" as required by the claims of the present application, but states that the examiner's position is that the term "vortex method" is equivalent to the "convection vortex" of the instant claims with respect to patentability (paragraph 6, page 3). The Office action also admits that Kawabe does not mention rotating a container to create a vortex, but states that movement of the container which would be necessary to carry out Kawabe's method is held to be equivalent to the rotating step of the present claims (paragraph 6, page 4).

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Applicants agree that Kawabe is silent regarding "convection vortex" and rotating the container to create one. They point out that Kawabe is also silent regarding using the convection vortex to eject the molten composite material from the container, as required by the claims. Even if Kawabe were held to teach or suggest equivalents to some of the steps of the claims (which Applicants do not admit), this further deficiency of the reference prevents establishment of a *prima facie* case of obviousness. Therefore, Applicants respectfully submit that a *prima facie* case has not been established, and that the claims are not obvious in view of the Kawabe reference. It is believed that the rejection is hereby overcome.

Claims 1-3, 6, 8, 9, 21, 22, 26 and 27 are rejected under 35 U.S.C. §103(a) as being obvious over WO 00/37241, to Wilson. The rejection is traversed.

The Wilson application relates to a method for producing articles composed of a thermoplastic polymer reinforced with nanoparticles. In the method, the polymer/nanoparticle combination is melted and the molten material is rotated in a mold cavity (Abstract). The application does not mention creating a convection vortex in a pool of molten material in the container in order to incorporate the nanoparticles into the molten material and form a molten composite material. Nor does it mention ejecting the molten composite material from the container. The Office action states that, although the reference does not use the term "convection vortex", rotation of the molten material in the mold cavity in the Wilson method would result in convection and in creating a vortex, and holds this to be equivalent to creating a convection vortex.

Applicants point out that the purpose of rotating the mold cavity in Wilson's method is so that the molten material conforms to the surface of the mold (Abstract); a vortex would be an undesirable feature in a process that seeks to fill a mold cavity in a conformal manner. The purpose is not to incorporate the nanoparticles into the molten material, as required by the instant claims, since the reference discloses that the polymer and the nanoparticles are premixed before they are added to the mold. Because of these distinctions, one of ordinary skill in the art would not consider rotation of the mold cavity in Wilson's method to be equivalent to the rotation of the claimed method that creates a convection vortex. Therefore, the reference is deficient in failing to teach or suggest creating a convection vortex and using the vortex to eject the material from the container, and Applicants submit that a *prima facie* case of obviousness

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has not been established with respect to the WO 00/37241 application. It is believed that the rejection is hereby overcome.

Claims 1-10, 12-15, 21-28 and 31-37 are rejected under 35 U.S.C. §103(a) as being obvious over US 6,251,159, to Angeliu. The rejection is traversed.

The Angeliu '159 patent relates to methods for dispersion strengthening of metallic melts by adding nanophase particles to the melt and dispersing the particles so that they are spaced from each other at a distance that provides dispersion strengthening (Abstract, claim 1). Dispersion of the particles is accomplished by "convection mixing from the heat of the metallic melt" (col. 4, lines 50-51) or by "an appropriate mixing device, such as a stirrer, electromagnetic mixing, forcing gas mixing, or physical mixing devices" (col. 4, lines 52-55). The patent does not mention rotating the mixture to create a vortex or using the vortex to eject the molten material from the container.

The Office action admits that Angeliu does not specify rotating the container to create a convection vortex, but states that this is not a patentable distinction, as the reference teaches mixing the particles into the matrix using a stirrer, electromagnetic mixing or physical mixing devices. Applicants submit that this general teaching regarding mixing methods *that do not include convection vortex*, in combination with the failure of the reference to teach or suggest use of the vortex to eject material from the container, as required by claim 1 and its dependent claims, are insufficient to establish a *prima facie* case of obviousness with respect to the Angeliu '159 patent. It is believed that the rejection is hereby overcome.

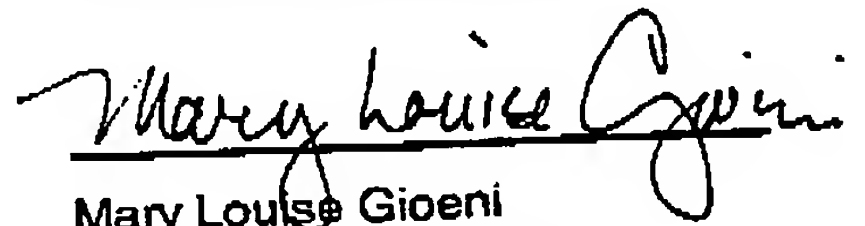
Claims 1-10, 12-15, 21-28 and 31-37 are rejected for nonstatutory obviousness-type double patenting over claims 1-30 of US 6,939,388 to Angeliu. The rejection is traversed.

The claims of the Angeliu '388 patent relate to methods for forming a nanocomposite material by dispersing a nano-sized material in a molten material using ultrasonic energy and solidifying the molten material (claim 1). Like the Angeliu '159 patent, the '388 patent does not mention rotating the mixture to create a vortex or using the vortex to eject the molten material from the container. The Office action admits that the claims do not recite a convection vortex but asserts that it would have been obvious to employ a convection vortex in view of the teaching in the Angeliu '159 patent that convection mixing or electromagnetic mixing may be used to

disperse nanoparticles in a metallic melt. Applicants respectfully point out that neither of these mixing methods necessarily involve a vortex, or rotating the container to produce one. Therefore, Applicants submit that, because the reference fails to teach or suggest creating a convection vortex by rotating the container or use of the vortex to eject material from the container, as required by the claims, the claims are not obvious over the claims of the Angeliu '388 patent. It is believed that the rejection is hereby overcome.

In view of the above Remarks, Applicants respectfully request allowance of all claims pending herein.

Respectfully submitted,



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